



US006208531B1

(12) **United States Patent**
Vinciarelli et al.

(10) Patent No.: **US 6,208,531 B1**
(45) Date of Patent: **Mar. 27, 2001**

(54) **POWER CONVERTER HAVING
MAGNETICALLY COUPLED CONTROL**

(75) Inventors: **Patrizio Vinciarelli, Boston; Louis A. Bufano, Tewksbury, both of MA (US)**

(73) Assignee: **VLT Corporation, San Antonio, TX (US)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1281 days.

(21) Appl. No.: **08/631,793**

(22) Filed: **Apr. 10, 1996**

Related U.S. Application Data

(63) Continuation of application No. 08/077,011, filed on Jun. 14, 1993, now abandoned.

(51) Int. Cl.⁷ **H02M 3/335**

(52) U.S. Cl. **363/21; 363/97**

(58) Field of Search **363/15, 16, 20, 363/21, 95, 97, 144, 147**

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,522,509	8/1970	Hasenbalg	321/2
3,771,040	* 11/1973	Fletcher et al.	363/97
4,024,449	5/1977	Burrie et al.	321/2
4,080,585	3/1978	Molthen	336/220
4,201,965	5/1980	Onyshkevych	336/180
4,439,821	* 3/1984	Grippe	363/97
4,455,545	6/1984	Shelly	336/200
4,622,627	11/1986	Rodriguez et al.	363/37
4,683,528	* 7/1987	Snow et al.	363/21
4,709,315	11/1987	Ramos	363/21
4,712,160	12/1987	Sato et al.	361/388
4,761,724	8/1988	Brown et al.	363/21

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

2054457 5/1972 (DE) H01F/15/00

3501052	7/1986	(DE)	.....	H02M/3/28
2 641 438	7/1990	(FR)	.....	H01F/27/28
52-115116	9/1977	(JP)	.....	H04N/5/44
54-110424	8/1979	(JP)	.....	H01F/27/28
55-154712	12/1980	(JP)	.....	H01F/23/00
63-198387	12/1988	(JP)	.....	H02M/3/28
3-97386	10/1991	(JP)	.....	H02M/3/28
4-352306	12/1992	(JP)	.....	H01F/27/08

OTHER PUBLICATIONS

Pelly et al., "Power MOSFETs Take the Load Off Switching Supply Design", *Electronic Design*, Feb. 17, 1983, pp. 135-139.

Wong, "Design Entry, 'Compact Power Unit Raises Supply's Switching Rate By An Order of Magnitude'", *Electronics Design*, Apr. 4, 1985, pp. 161-168.

General Electric brochure, "SwitchMod™", 6PM Series. May 1993.

(List continued on next page.)

Primary Examiner—Jeffrey Sterrett

(74) *Attorney, Agent, or Firm*—Fish & Richardson P.C.

(57) **ABSTRACT**

A transformer having galvanically isolated windings defines a primary side and a secondary side of a power conversion apparatus. A switch couples power from a source on the primary side via the transformer to a load on the secondary side. A first circuit assembly has primary-side circuitry galvanically coupled to a port for connection to an input power source. The primary-side circuitry includes a primary-side communicator for sending or receiving control information used in controlling operation of the power conversion apparatus. A second circuit assembly has secondary-side circuitry galvanically coupled to a port for connection to a load. The secondary-side circuitry includes a secondary-side communicator for sending or receiving the control information. The first and second circuit assemblies are mechanically separable as assemblies from one another, are galvanically isolated from one another, and are configured to be placed in positions relative to one another to enable the primary-side and secondary-side communicators to cooperate to pass the control information.

21 Claims, 15 Drawing Sheets

